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PREVALENCE OF MENISCI AND ANTERIOR CRUCIATE LIGAMENT TEAR AMONG ATHLETES IN SAUDI ARABIA: A RETROSPECTIVE ASSESSMENT WITH MRI

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Abstract: This cross-sectional study was to find the prevalence of knee injuries in Riyadh city. Method: We screened 1100 Magnetic Resonance Images related to sports injuries of male patients from two tertiary care hospitals over a period of four years from January 2013 to December 2016. Results: Data was analyzed using SPSS. Our findings revealed that the patient's age ranged between 16 to 45 years and the prevalence of knee injury was 61.2%, where 41.8% had ACL tear and 44.9% patients with Meniscus tear. The younger (16-30) adults experienced 1.5 times the associated risk compared to the middle aged (31-45) men was statistically significant with ?2 - value = 12.59 (P-value=0.000). Conclusion: Awareness programs and preventive measures on injuries should be provided mainly for the younger adults less than 30years.

Keywords: kneeInjuries, ACL tear, Meniscus tear, MRI

Japan, Osaka

Introduction:

Musculoskeletal injuries during sports activities are common and usually result in pain, disability and disruption of an athletes' career. [1] Commonly the knee is affected because it is the major weight bearing joint that provides stability and mobility during sports activity. [2]As per Dennis [3] study, sports injuries are abnormalities on the musculoskeletal system resulting from repeated bouts of physical activity or isolated exposure to physical energy during sports competition or training. These injuries can be classified as over-use or acute based on the mechanism of injury. [4] Acute sport injuries are caused by high physical energies while over-use injuries are associated with repetitive low-magnitude energies resulting in sub-optimal recovery of the affected part. [5]

In the United States, the most common intra-articular injury associated with sports activity involve the Menisci or Anterior Cruciate Ligament (ACL). [6] According to Gupta [7] ACL injuries are associated with rotational injuries seen in basketball, football and skiing as well common among the adolescent. It is estimated that about 250,000 cases are reported per year in the USA.[5] Further 175,000 patients suffering from ACL injuries undergo reconstruction within the USA. In France, it is reported that an estimated 15,000 cases of ACL were attributed to skiing [8] and Guenon et al. [9] suggest that ACL injuries result from high energies that result in flexion and external rotation of the knee with a valgus force. Epidemiological studies conducted on ACL injuries suggest that the incidence and prevalence of these tears differs per age, gender and sport activities. [6]

On the other hand, Menisci tears have been attributed to increased orthopedic procedures among athletes. [2] The menisci play a crucial role in knee homeostasis, lubrication, joint stability, proprioception and shock absorption.[10] In another study, menisci injuries account for 20% of all non-fatal injuries in European Sports resulting in high economic burden in the diagnosis and treatment. Chronic ACL injuries resulting in menisci tear must be repaired surgically. Early diagnosis and treatment of both menisci and ACL injuries is crucial for preservation of the joint function. [11] In Saudi Arabia, there is increasing participation in both local and international sports. However, due to lack of a national injury tally system, it is difficult to account for sports injuries within the country. [12] The present study was carried out within Riyadh city, Saudi Arabia.

Objectives

-To determine the prevalence of knee injuries attributed to sports in Riyadh city.

-To establish the mechanism of injuries associated with ACL and Menisci injuries among athletes within Saudi Arabia.

Materials & Methods:

In this Cross Sectional-record based study, all MRI of 1100 male patients with age from 16 to 45 years from January 2013 to December 2016, referred to the MRI departments at the King Saud Medical City (Hospital 1, N=550) and the Prince Faisal Bin Fahad Sport Medicine Hospital (Hospital 2, N=550)

were included. The study focused on patients who underwent MRI following knee injuries related to sports activities along with demographic, socio-economic data, physical examination findings, and clinical history of the patients were recorded.

Inclusion criteria: MRI of knee injuries due to anterior cruciate ligament and meniscal injury attributed to sports activities (both professional and amateur).

Exclusion criteria: MRI of knee injuries with damage to other soft tissues & bone and knee injuries not attributed to sport activities.

These MRI acquisition knee images were done using TxRx 16 channels knee coil for Siemens Skyra 3T. The patients were studied using the following sequences:

- Transverse PD tse fat saturation (proton density, time spin echo) with FOV X FOV phase (150 X100) slice thickness 3 distance factor 30%, TR 4300 TE 33, average 3 while number of slice 30.
- SAG (Sagittal) PD fat saturation tse with FOV X FOV phase (140 X100) slice thickness 3 distance factor 25 %, TR 3000 TE 32, average and number of slice 25.
- SAG T1 tse with FOV X FOV phase (150 X100) slice thickness 3 distance factor 25%, TR 600 TE 13, average 2 and number of slice 25.
- COR (coronal) T2 fat saturation tse with FOV X FOV phase (140 X100) slice thickness 3 distance factor 30%, TR 4500 TE 90, average 2 and number of slice 25.
- SAG oblique T2 tse with FOV X FOV phase (130 X100) slice thickness 2 distance factor 0%, TR 3000 TE 80, average 2 and number of slice 20.
- COR PD oblique fat saturation with FOV X FOV phase (130 X100) slice thickness 2 distance factor 0%, TR 2600 TE 22, average 3 while number of slice 20.

The images were analyzed and reported by an experienced musculoskeletal radiologist consultant. Abnormalities such as ligament tears, meniscal degeneration, bone marrow edema, bone contusion, joint effusion, baker cyst and tumors were noted on all the patients. However, emphasis based on the study focused on anterior cruciate ligament and meniscal injuries diagnosed during the imaging studies.

This study was approved by the institutional review board of the King Saud Medical City (IRB# H1RI-12-Jan17-01).

Data analysis: The data obtained from the study were subjected to statistical analysis using SPSS version 21 software.[13] The results are presented as descriptive statistics - frequency, Percentage, Range, Mean, Standard error and inferential statistics[14] - Chi Square, Odds ratio and tested for statistical significance at 5% level.

Japan, Osaka

Results:

Table1. Descriptive statistics of the patients

Variables		Both Hospitals N=1100 (%)	Hospital 1 N=550(%)	Hospital 2 N=550(%)
1. Age (years)	- 16-30	632 (57.5)	325(59.1)	307(55.8)
	31-45	468 (42.5)	225(40.9)	243(44.2)
2. ACL Tear	- Nil	640 (58.2)	303(55.1)	337(61.3)
	Complete	304 (27.6)	207(37.6)	97(17.6)
	Partial	156 (14.2)	40(7.3)	116(21.1)
3. Meniscus Tear	- Nil	607 (55.2)	354(64.4)	252(45.8)
	Tear	5 (0.5)	6(1.1)	0
	Lateral	79 (7.2)	26(4.7)	53(9.6)
	Medial	335 (30.5)	135(24.5)	200(36.4)
	Lateral & Medial	74 (6.7)	29(5.3)	45(8.2)

Table2. Inferential Statistics for ACL tear

Variables	Both Hospitals ACL Tear		Hospital 1 ACL Tear		Hospital 2 ACL Tear	
	Present	Absent	Present	Absent	Present	Absent
Age (years)						
16 – 30	293	339	157(48.3)	168(51.7)	136(44.3)	171(55.7)
31 – 45	167	301	90(40.0)	135(60.0)	77(31.6)	166(68.3)
χ^2 - value (P-value)	12.59 (0.000)*		12.46 (0.002)*		10.28 (0.006)*	
Risk Ratio (95% CI)	1.29* (1.12 - 1.50)		1.40 (0.99 – 1.97)		1.71* (1.20 - 2.43)	

**Statistically Significant at 5% level*

Table3. Inferential Statistics for MENISCUS Tear

Variables	Both Hospitals MENISCUS Tear		Hospital 1 MENISCUS Tear		Hospital 2 MENISCUS Tear	
	Present	Absent	Present	Absent	Present	Absent
Age (years)						
16 - 30	267	365	115(35.4)	210(64.6)	152(49.5)	155(50.5)
31 - 45	227	241	81(36.0)	144(64.0)	146(60.1)	97(39.9)
χ^2 - value (P-value)	4.25 (0.03)*		0.02 (0.88)		6.10 (0.01)*	
Risk Ratio (95% CI)	1.14* (1.01 – 1.30)		-		1.21* (1.04 – 1.41)	

*Statistically Significant at 5% level

Both Hospital: The patients' age ranged from 16-45years with a mean of 29.6years, 632 (57.5%) were aged between 16-30years and 468(42.5%) above 30years. About 460 patients had ACL tear, among them 304(66.0%) had complete tear and 156(34.0%) were with partial tear. 498(45.25%) had meniscus tear, 79(7.2%) were in lateral, 335(30.5%) in medial and 74(6.7%) had both lateral and medial meniscus tear. In Table 1&2, 198(65.1%) patients between 16-

30years and 106(34.9%) ranging 31-45years had complete ACL tear. Around 95(60.9%) from 16-30years and 61(39.1%) between 31-45years had partial ACL Tear. We observed a statistically significant association [?2 - value = 12.59, P-value=0.000] between the age and ACL tear. The younger (16-30) adults had 1.5 times the associated risk compared to the middle aged (31-45) men. From 632patients between 16-30years, 44(7.0%) had lateral meniscus tear, 175(27.7%) were with medial meniscus tear and 46(7.3%) had both lateral & medial meniscus tear. From Table 3, we can observe that the athletes between 31-45 years had 1.4 times the risk of having Meniscus tear compared to (16-30) years.

Fig 1. ACL Tear for Age Group (%)

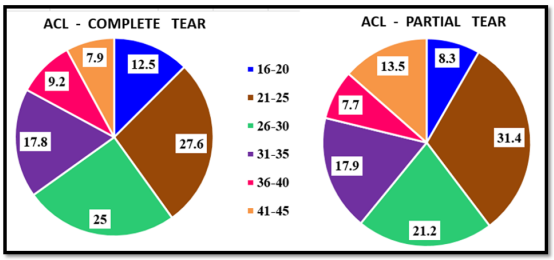
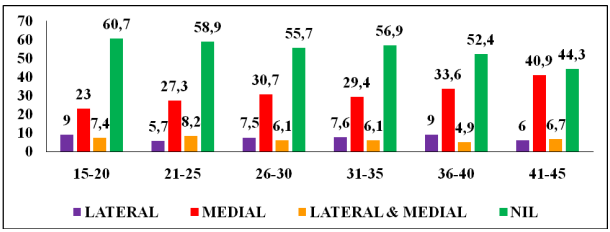


Fig 2. Meniscus Tear for Age Group (%)



Among 304 patients with Complete ACL tear, 25(8.2%) had lateral meniscus tear, 112 (36.8%) with Medial meniscus tear and 48(15.8%) had both lateral and medial meniscus tear. Among 156 patients with Partial ACL tear, 24(15.4%) had lateral meniscus tear, 60 (38.5%) with Medial meniscus tear and 12(7.7%) had both lateral and medial meniscus tear. Among 640 patients with no ACL tear, 30(4.7%) had lateral meniscus tear, 163 (25.5%) with Medial meniscus tear and 14(2.2%) had both lateral and medial meniscus tear. Fig 1 shows the distribution of 304 patients with complete ACL tear & 156 with partial ACL tear and Fig 2 presents the meniscus tear for different age groups.

Hospital 1: Among 550 patients, 325(59.1) were aged between 16-30years and 225(40.9) above 30years. 247 (44.9) patients had ACL tear, among them 207(37.6) had complete tear and 40(7.3) were with partial tear. 196(35.6) had

meniscus tear, 26(4.7) were in lateral, 135(24.5) in medial and 29(5.3) had both lateral and medial meniscus tear. 313(56.9%) had at least one tear.

Among 207 patients with complete tear, 140(67.6%) were young adults and 67(32.4%) were above 30years, from 40 patients with partial tear, 17(42.5) were less than 30years and 23(57.5) were above 30years. We observed a statistically significant association [?2- value = 12.46,P= 0.002] between the age and ACL tear (Table 1&2). The younger (16-30) adults had 1.4 times the associated risk compared to the middle aged (31-45) men. From 325patients between 16-30years, 13(4.0) had lateral meniscus tear, 78(24.0) were with medial meniscus tear and 22(6.8) had both lateral & medial meniscus tear.

Among 207 patients with Complete ACL tear, 10(10.3%) had lateral meniscus tear, 44 (45.4%) with Medial meniscus tear and 21(21.6%) had both lateral and medial meniscus tear. Among 116 patients with Partial ACL tear, 22(19.0%) had lateral meniscus tear, 42 (36.2%) with Medial meniscus tear and 12(3.6%) had both lateral and medial meniscus tear. Among 337 patients with no ACL tear, 21(62%) had lateral meniscus tear, 114 (33.8%) with Medial meniscus tear and 12(3.6%) had both lateral and medial meniscus tear.

Hospital 2: Among 550 patients, 307(55.8) were aged between 16-30years and 243(44.2) above 30years. 213 (38.7) patients had ACL tear, among them 97(17.6) had complete tear and 116(21.1) were with partial tear. 196(35.6) had meniscus tear, 26(4.7) were in lateral, 135(24.5) in medial and 29(5.3) had both lateral and medial meniscus tear. Three hundred and sixty (65.5%) had at least one tear.

From 97 patients with complete tear, 58(59.8%) were young adults and 39(40.2) were above 30years, from 116 patients with partial tear, 78(67.2) were less than 30years and 38(32.8) were above 30years. We observed a statistically significant association [?2- value = 10.28, P= 0.006] between the age and ACL tear. The younger (16-30) adults had 1.7 times the associated risk compared to the middle aged (31-45) men. From 307patients between 16-30years, 31(10.1) had lateral meniscus tear, 97(31.6) were with medial meniscus tear and 24(7.8) had both lateral & medial meniscus tear.

Among 97 patients with Complete ACL tear, 10(10.3%) had lateral meniscus tear,44 (45.4%) with Medial meniscus tear and 21(21.6%) had both lateral and medial meniscus tear. Among 116 patients with Partial ACL tear, 22(19.0%) had lateral meniscus tear, 42 (36.2%) with Medial meniscus tear and 12(3.6%) had both lateral and medial meniscus tear. Among 337 patients with no ACL tear, 21(62%) had lateral meniscus tear, 114 (33.8%) with Medial meniscus tear and 12(3.6%) had both lateral and medial meniscus tear. We observed a statistically significant association [?2- value = 4.25, P-value = 0.03] between the age and meniscus tear in Table 3.

The main findings were

1. The prevalence of sports injuries was (673/1100) 61.2%.
2. The prevalence of ACL tear was (460/1100) 41.8%.
3. The prevalence of Meniscus tear was (493/1100) 44.9%.

Japan, Osaka

Discussion:

MRI should only apply to complement the findings in doubtful cases before and after the performance of the examination. The use of magnetic resonance image is necessary for multiple injuries in which the examination by the clinician is inconclusive. The health practitioner should then use arthroscopy for treating such knee injuries. [4] Therefore, use of MRI in treating knee injuries has to be an optional examination, rather than the routine testing. The use of physical examination together with the magnetic resonance image is appropriate because their sensitivity for the lateral meniscus remains higher for the examiners. [2] As reported by Hetta[15], the use of the two approaches makes the sensitive nature of anterior cruciate ligaments and medial meniscus to be higher. The use of magnetic resonance imaging should involve recurring process towards the delivery of surgery. As shown in Guenther's [1] results, it may follow that MRI in health sector remains to be the most accurate, powerful, non-invasive method that can be appropriate for diagnosing tears within the meniscal structures. It has also been able to control the care given to the patient by the process of eliminating unnecessary diagnostic arthroscopies. [12]It also works by identifying the alternative diagnosis whose presentation in the clinical sector has remained to mimic meniscal tears.

From table 3, it is evident that youths are exposed to more ACL injuries and less Meniscus tear as compared to adults. The group of teens had the higher incidents of damage in different sports. [16] The table is a good representation on how several youths are injured occasionally when they are involved in sporting events around the community.

Youths are prominent to injuries because their populations are increasing in number. Most of the injuries among adolescent occur because they always participate in sports that associates significantly with injuries like basketball and football. [10] These games have led to greater impact to the management of injuries among youths through prompt diagnosis processes. Injuries among youth continue to rise with the popularity of youth sport continues to raise making participation of young children to increase.According to various examinations done, thirty to forty-four million in preadolescent and adolescent always involve themselves in high school athletes and organized sports. [17] From Hetta's results, many youths involved in sports along with leisure actions are the ones injured more. Besides, slightly more than half of the severe knee injuries that results from sporting activities results in medical disqualifications for a reason and approximately the quarter of the injuries that need surgical interventions.7 It is also evident that cases of injuries are high among youths because incidences of fractures in high school associate with sports that they participate in during their life at school. Such sporting activities consist of rugby, hockey, basketball, and football.

Epidemiology of sports has shown that sports injuries to be recognizable as the global health problem. The situation requires the public health approach to reducing their influence on people. Moreover, medical meniscal tears, particular

youths involved in handling damages rises steadily in numbers greater than a period of twelve months after ACL. According to Colombet et al., the modern renovation of the ACL may remain warranted to assist in the reduction of the danger of further damage of medical meniscal. It can help in controlling the threat even when in patients whose initial damage to transpire over twelve months prior real care. As shown in Dufka'set al. [18], the continuous rise in youths participating in sports combined with increased duration along with intensity training has led to the substantial increase in cases of knee injuries. The exclusive physiology along with anatomy of the increased sportsmen places them at the risk of developing predictable patterns of injury around the knee. There is the need for the experienced surgeons to review anatomy, pathophysiology, workup, evaluation in health, along with treatment of common injuries that affect the knee of emerging athlete in Saudi Arabia. [19] A clinical evaluation can help in ruling out other knee pathologies like patellar dislocation, Osteochondritis dissecans, or physical injury. [15] Therefore, the imaging modality of choice for meniscal pathology is the magnetic resonance scan. Magnetic resonance in the skeletally immature knee lacks the same diagnostic accuracy as presented within the adult population. [2] Besides, the use of MRI has led to a definite purpose for the treatment of injuries to the ligament of knees.

Conclusions:

The story of MRI remains an essential factor in the identification of meniscal as well as anterior cruciate ligaments injuries that always occur in sporting activities. The use of MR imaging leads to high adverse analytic value creating it to be the appropriate alternative device for screening than the process of evaluation of arthroscopic among those who suffer from soft tissue shock towards the knees. The pooled data from the study and the variability can aid in the provision of evidence essential for the future investigation in addressing risk factors and treatments for knee injuries among athletes. In most cases, damage to knee extension is regard to be the post-operative complications of reconstruction of anterior crucial ligaments. Therefore, most common cause for impaired knee extensions sports is the idea of graft impingement followed by cyclops lesions also referred to as localized arthrofibrosis.

Other reasons include excessive graft tension, inadequate rehabilitation, fibrosis of the fat pad, supra-patellar, anatomical graft position, and intercondylar adhesions, entrapment of the patella and capsular contracture. Proper diagnoses of injuries of ligament of the knee can follow appropriate surgeries by orthopedic. The diagnosis must be through the process of physical examination with mutual aid from the magnetic resonance image.

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